PESTS NOT KNOWN TO OCCUR IN THE UNITED STATES OR OF LIMITED DISTRIBUTION, NO. 26: MEDITERRANEAN FRUIT FLY

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Order: Family — Diptera: Tephritidae

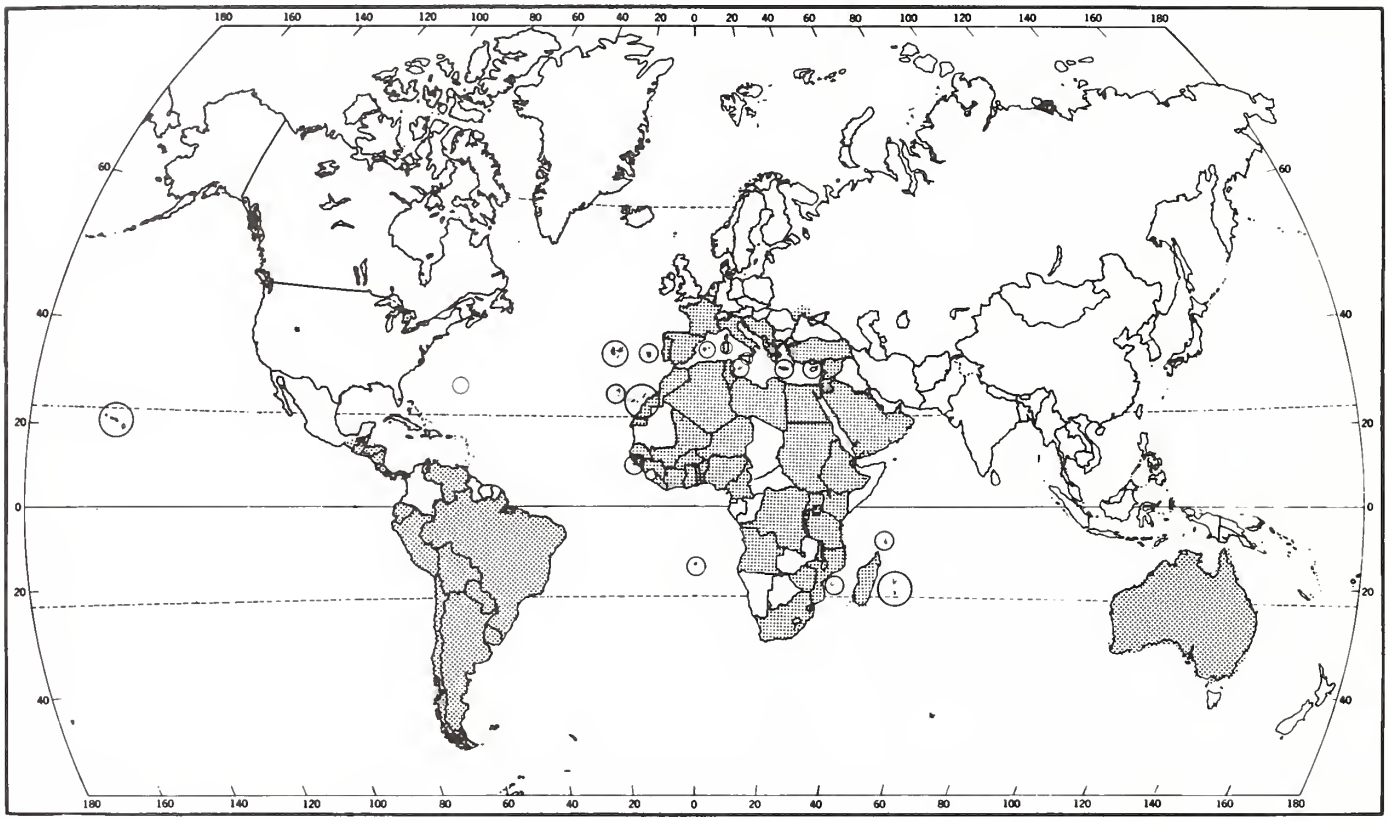
Pest — MEDITERRANEAN FRUIT FLY 1/
Ceratitis capitata (Wiedemann)

Economic Importance — This species is an extremely destructive and widespread pest of citrus and numerous other fruits. Some Mediterranean areas have experienced up to 100 percent infestation to stone fruits. Greece in 1928 had a 50 percent loss in citrus. *C. capitata* has been eradicated several times from the United States in past years. However, its reappearance in California in June 1980 created a battle which lasted for over 2 years, and has just recently been successfully concluded. The first time this tephritid appeared in Florida, it was not found until over 70 percent of the fruit was infested in some areas; eradication costs exceeded $7,000,000. Later infestations were eradicated for significantly less due to improved detection, quarantine, and control methods (Oakley 1948-1954, personal communication).

General Distribution — In the following list the asterisk indicates countries with only occasional infestations:

Albania, Algeria, Angola, Argentina, Australia (except Tasmania), Austria*, Azores, Belgium*, Bermuda, Bolivia, Botswana, Brazil, Burundi, Cameroon, Canary Islands, Cape Verde Islands, Chile, Costa Rica, Cyprus, Dahomey, Ecuador, Egypt, El Salvador, Ethiopia, France, Germany*, Ghana, Greece (includes Crete), Guatemala, Guinea, Honduras, Hungary*, Israel, Italy (includes Sardinia, Sicily), Ivory Coast, Jordan, Kenya, Lebanon, Liberia, Libya, Madagascar, Madeira Islands, Malawi, Mali, Malta, Mauritius*, Mexico (Chiapas area), Morocco, Mozambique, Netherlands*, Nicaragua, Niger, Nigeria, Panama, Paraguay, Peru, Portugal, Reunion, Rwanda, Saint Helena, Saudi Arabia, Senegal, Seychelles, Sierra Leone, South Africa, Spain (includes Balearic Is.), Sudan, Switzerland*, Syria, Tanzania, Togo, Tunisia, Turkey, Uganda, Upper Volta, Uruguay, USSR (Crimea, southern Ukraine), Venezuela, Yugoslavia, Zaire, and Southern Zimbabwe (Commonwealth Institute of Entomology 1967, Weems 1981, personal communication).

1/ This article is a revision of: Anonymous. Mediterranean Fruit Fly in the U.S.-1975; CEIR 25(43):835-838; 1975



Ceratitis capitata distribution map prepared by USDA, APHIS, PPQ, Biological Assessment Support Staff

Infestations in the United States: In Hawaii since 1910, in Florida April 1929 to July 1930, April 1956 to November 1957, June 1962 to February 1963, and August to November 1981, in Texas June to July 1966, in California September to November 1975, June 1980 to September 1982. Except for Hawaii, all infestations have been eradicated (Oakley 1948-1954, personal communication).

Hosts

Mediterranean fruit fly typically attacks thin-skinned, ripe succulent fruits. However, this pest has been reported in varying degrees on more than 400 hosts, preference depending on geographical locality. An extensive unpublished list of hosts has been compiled by Emergency Programs and the Biological Assessment Support Staff, Hyattsville, MD. In the lists given below, an asterisk indicates which host must be overripe or cracked to be infested.

The most common hosts 2/ are stone, pome, and citrus fruits: Prunus spp. (almond, apricot, cherry, nectarine, peach, plum), Pyrus communis (pear), Malus sylvestris (apple), and Citrus spp. (calamondin, citron, grapefruit, lemon*, mandarin orange, sweet orange, pummelo, sweet lime).

Other hosts include 2/: Actinidia chinensis (kiwi), Annona spp., A. cherimola (cherimoya), A. muricata (soursop), A. reticulata (custard-apple), A. squamosa (sugar-apple), Argania spinosa = sideroxylon (Morocco ironwood), Blighia sapida (akee), Calocarpum sapota (sapote), Calophyllum inophyllum (Indiapoon beautyleaf), Capsicum spp., C. annuum (peppers), Carcinia xanthochymus (gourka), Carica papaya (papaya)*, C. quercifolia (dwarf papaya), Carissa spp., C. arduina (amatungula), C. grandiflora (Natal plum), Casimiroa edulis (whitesapote), Chrysophyllum cainito (starapple), C. oliviforme (satinleaf star), Citrofortunella mitis (calamondin orange), Coffea spp. (coffee), Crataegus spp. (hawthorn), Cydonia oblonga (common quince), Cyphomandra betacea (tree tomato), Diospyros decandra (persimmon), D. digyna (black sapote), D. kaki (Japanese persimmon), Dovyalis caffra (kei apple), D. hebecarpa (Ceylon gooseberry), Eriobotrya japonica (loquat), Eugenia spp., E. dombeyi (Spanish cherry), E. jambos (rose apple), E. malaccensis (mountain apple), E. uniflora (Surinam cherry), other spp., Feijoa sellowiana (pineapple guava), Ficus carica (fig), Fortunella spp., F. japonica (kumquat), Garcinia mangostana (mangosteen), Geoffroea decorticans (chanar), Gossypium spp. (cotton), Litchi chinensis (lychee), Lycopersicon esculentum (tomato), Malpighia glabra, M. punicifolia (Barbados cherries), Mangifera indica (mango), Manilkara zapota (sapodilla), Mespilus germanica (medlar), Mimusops elengi (elengi tree), other spp., Murraya exotica (jasminorange), Musa spp. (bananas)*, Ochrosia elliptica (bourbon orange), Olea europaea (olive), Opuntia spp., O. ficus-indica (Indian fig), Passiflora edulis (passion-fruit), Persea americana (avocado)*, Phoenix dactylifera (date palm), Pouteria campechiana (canistel), Psidium spp., P. cattleianum (strawberry guava), P. guajava (guava), Punica granatum (pomegranate)*, Spondias spp. (mombin), S. mombin (hog plum), S. purpurea (jocote), Syzygium malaccense (mountain apple), Terminalia spp., T. catappa (tropical almond), T. chebula (myrobalan nut), Theobroma cacao (cacao), Thevetia peruviana (yellow oleander), and Vitis vinifera (grape).

2/ A partial listing from the definitive list of hosts being created by Biological Assessment Support Staff

Characters

ADULTS - Length 3.5-5 mm. Body yellowish with brown tinge, especially on abdomen, legs, and some markings on wings. White setae on lower corners of face. Eyes reddish purple. Ocellar bristles present. Pair of bristles with enlarged spatulate tips next to inner margins of eyes on males. Thorax creamy white to yellow with characteristic pattern of black blotches; light areas with very fine white bristles, humeral bristles present. Dorsocentral bristles anterior of halfway point between supra-alar and acrostichal, fine black bristles scattered on dorsal surface with 2 narrow transverse light bands on basal half. Extended ovipositor 1.2 mm long. Wings broad and hyaline with black, brown, and brownish yellow marking. Wide brownish yellow band across middle of wing. Apex of anal cell elongate and parallel-sided. Dark streaks and spots in middle of cells in and anterior to anal cell. Wings droop on live flies.

EGGS - Length 1 mm, body very slender, curved, smooth, and shining white. Micropylar region distinctly tubercular.

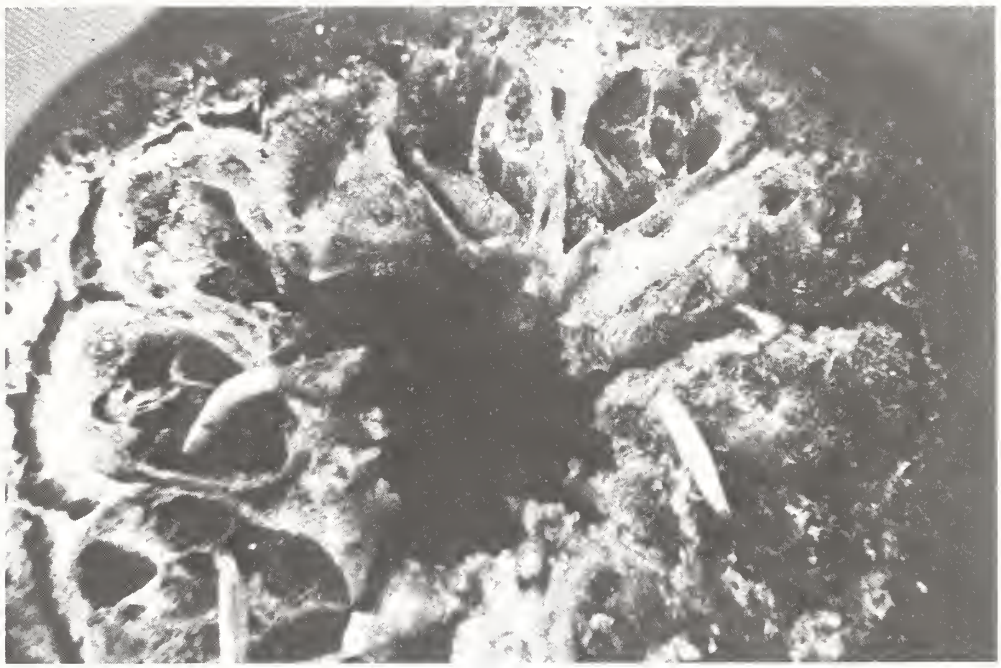
LARVAE - Length from 1.0 mm newly hatched to 6.8-8.2 mm fully grown. Elongate and pointed at head end, white or color of ingested food. Head with accessory teeth near oral hooks. Anterior spiracle bears 7-10 lobes in simple arc. Caudal spiracles in characteristic almost parallel pattern, not on raised surface, and without black rings or semicircles. Distinct low ridge connecting two tubercles on posterior swellings (observed on dry larval surface). Fully grown larvae "jump" repeatedly 25 cm or more when removed from fruit.

PUPAE - Length 4.0-4.3 mm, cylindrical, dark reddish brown, resembling swollen grain of wheat (Weems 1981).

Characteristic Damage

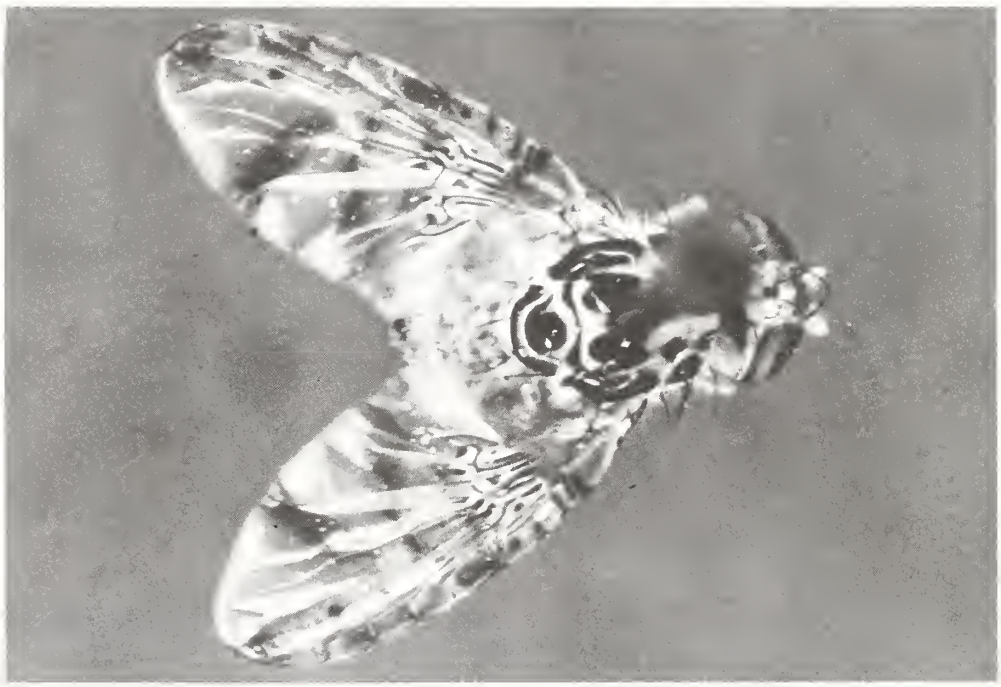
The female fly punctures the fruit and lays eggs just beneath the skin admitting decay organisms. The eggs hatch into larvae, which burrow deep into the fruit, where they feed and develop, and reduce the fruit interior to a rotten mass. Fruit loss can also occur from rots that develop around fly stings, whether eggs are deposited or not (Allen 1971).

(Fig. 1)



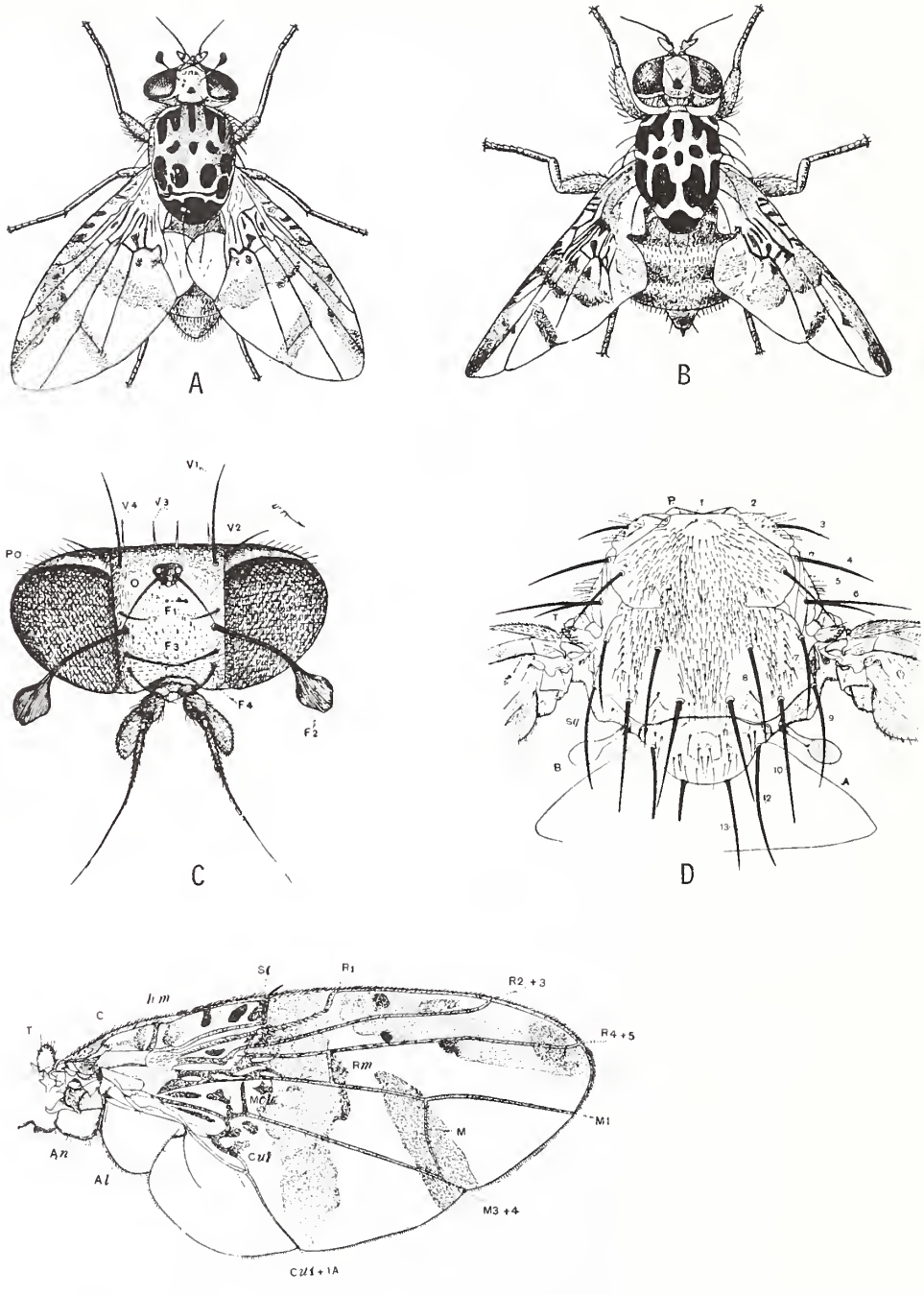
Ceratitis capitata larvae in fruit (USDA photo)

(Fig. 2)



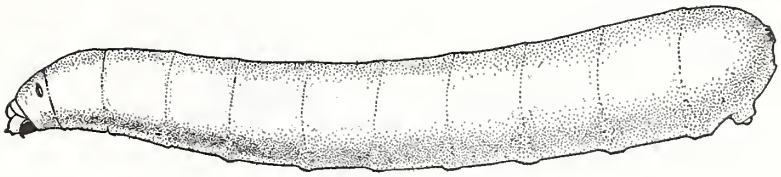
Ceratitis capitata: Female adult, dorsal view

(Fig. 3)



Ceratitis capitata (Wiedemann) adult: A. Male, dorsal view; B. Female, dorsal view, (Bodenheimer 1951); C. Head, frontal view of male showing spatulate tip bristles; D. Dorsal view of thorax showing key bristles; E. Wing, dorsal view, showing extension of apex of anal cell (Constantino 1930)

(Fig. 4)



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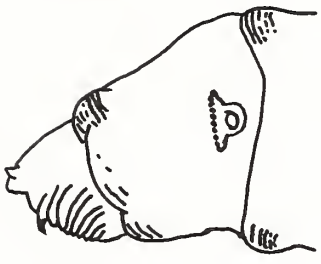

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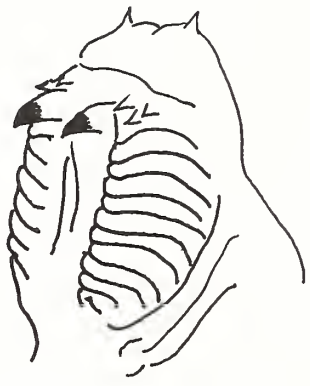

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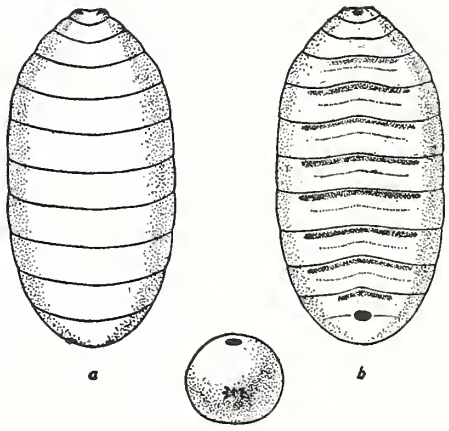
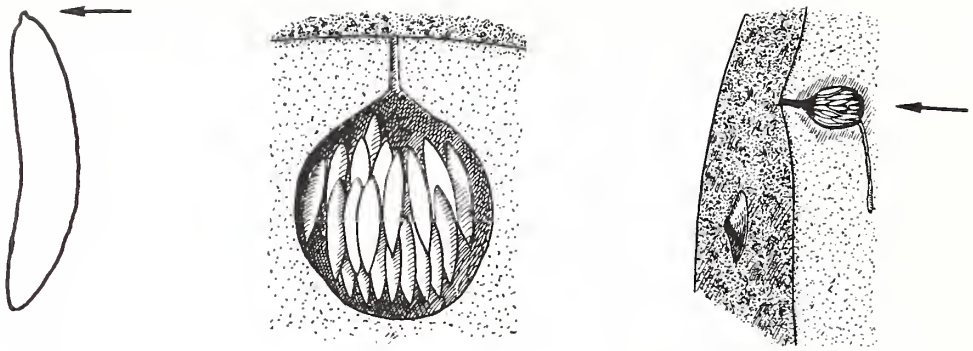


E

Ceratitis capitata: Third instar larva; A. Lateral view; B. Lateral view of head; C. Oblique lateral view of head; D. Oblique view of posterior; E. Pupae, dorsal, and ventral view. (A and E Back and Pemberton 1918) (B, C, D, sketches by G. C. Steyskal, USDA, ARS, retired)

(Fig. 5)



Ceratitis capitata: Immatures. A. Egg showing tubercular area of micropyle; B. Egg cavity in peach; C. Egg cavity in orange (Bodenheimer 1951)

Biology

Eggs are laid in an egg cavity in fruit, hatch in 2-3 days at 26.1°C. Larvae tunnel throughout the fruit and feed for 6-10 days at 24.4-26.1°C. Third instar larvae leave the fruit to pupate in soil or on whatever is available. Adults emerge from the pupae in 6-13 days at 24.4-26.1°C. They can fly a short distance, but winds will carry them 2.4 km, or more. Newly emerged adults must feed on a proteinaceous substance to become sexally mature. The females can begin egg laying after 4-5 days at 26.1-26.7°C. This preoviposition period, ranging 2-163 days, is shortened by warm temperature or several hours exposure to the sun. Males mature faster than females.

A mated female searches for a soft, injured, or punctured spots on fruit where she will lay 1-10 eggs in an egg cavity 1 mm deep. A female has the potential to lay 300 or more eggs. Because females favor ovipositing in previously prepared egg cavities other females may deposit in the same cavity. A cavity may contain several hundred eggs or larvae. Such an oviposition cavity reaches deeper into fruit pulp with each successive hatch.

Temperature is one limiting factor. Females will not oviposit when temperatures drop below 17°C (the air threshold temperature), although several hours of exposure to the sun overcomes this limitation. Development in egg, larval, and pupal stages stop below 9.7°C (the ground threshold temperature). The pupal stage allows the species to withstand unfavorable conditons, such as lack of food, water, and temperature extremes.

When host material is available for many successive months, temperatures range 16-32°C, and relative humidity is between 75-80 percent, successive generations will be continuous. The period for one generation is 18-33 days under favorable conditions. Lack of fruit for 3-4 months reduces the population to a minimum. Heavy infestations do not suddenly appear; they have been developing somewhere on a reservoir of host fruits.

Adults usually die in 2 months at 25°C. A few will survive up to a year or more under favorable conditions of food (fruit, honeydew, or plant sap), water, and cool temperatures. Without food a newly emerged adult dies in 4 days (Weems 1981).

The number of day degrees can be used to predict the number of generations in an area. The average daily temperature (maximum plus minimum divided by 2) minus the threshold temperature (see above) equals the number of day degrees; 622 are necessary for one generation (U.S. Department of Agriculture 1982).

Detection Notes

1. Detection is easiest during the summer. Breeding is continuous when temperatures are above 16°C.

2. Watch for fruit prematurely dropped or with softened, darkened, and broken-down areas. Cut up suspect fruit, submit for identification in alcohol any larvae in fruit pulp, especially if part of the fruit is sound.

3. Watch for oviposition (egg) punctures surrounded by small elevated crater, and large holes left by emerging mature larvae (pupation is in the soil).

4. Adults are trapped in or near host trees in trimedlure baited Steiner traps or in Frick traps baited with ammonium carbonate, usually combined with trapping for other fruit fly species (Allen 1971). Trimedlure baited Jackson traps supplemented by Mcphail traps baited with yeast tablets or a protein hydrolysate (PIB-7) in water were used in the recent infestation in California for delimiting surveys (see below).

5. The action plan for dealing with a detected infestation has been completed by Emergency Programs (USDA, APHIS, PPQ) and cooperating State Departments of Agriculture (U.S. Department of Agriculture 1982).

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